Impact of measurement system characteristics on advanced sounder information content

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ABSTRACT

Advanced satellite sensors are tasked with improving global observations of the Earth's atmosphere, clouds, and surface to enable enhancements in weather prediction, climate monitoring capability, and environmental change detection. Achieving such an improvement in geophysical information inferred from these observations requires optimal usage of data from current systems as well as instrument system enhancements for future sensors. This presentation addresses results of tradeoff studies evaluating the impact of spectral resolution, spectral coverage, instrument noise, and a priori knowledge on remote sensing system information content, with a specific emphasis on thermodynamic state and trace species information obtainable from advanced atmospheric sounders. Particular attention will be devoted toward information achievable from the Atmospheric InfraRed Sounder (AIRS) on the NASA EOS Aqua satellite in orbit since 2002, the Infrared Atmospheric Sounding Interferometer (IASI) aboard MetOp-A since 2006, and the Cross-track Infrared Sounder (CrIS) instrument to fly aboard the NPP and JPSS series of satellites expected to begin in late 2011. While all of these systems cover nearly the same infrared spectral extent, they have very different number of channels, instrument line shapes, coverage continuity, and instrument noise. AIRS is a grating spectrometer having 2378 discrete spectral channels ranging from about 0.4 to 2.2 cm^{-1} resolution; IASI is a Michelson interferometer with 8461 uniformly-spaced spectral channels of 0.5 cm^{-1} (apodized) resolution; and CrIS is a Michelson interferometer having 1305 spectral channels of 0.625, 1.250, and 2.50 cm^{-1} (unapodized) spectral resolution, respectively, over its three continuous but non-overlapping bands. Results of tradeoff studies showing information content sensitivity to assumed measurement system characteristics will be presented.
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